DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Alcohol, Drug Abuse, and
Mental Health Administration
National Institute of Mental Health
Intramural Research Program
Bethesda MD 20892

November 10, 1992

Dear Ken:

Sorry to be so late in replying to your urgent letter, but I was away at the Society of Neuroscience meeting in Anaheim, California and am just now trying to catch up.

I am enclosing a rewritten version of the 3 equations about which you had questions. I believe that they are correct. As for your questions, my answeres are as follows:

1) You will have to measure the λ_{MG} (i.e., equilibrium tissue:plasma distribution ratios for methylglucose) at various plasma glucose concentrations in the steady state. You know how to do this because you already have while you were here. The λ_{IAP} should not change with plasma glucose concentration except possibly when the changes in plasma glucose concentration are so severe that they might shrink or swell the brain because of osmotic effects.

2) $K_{T\text{-}MG}$ is a property of the glucose transporter. Since there is only one known transporter for glucose across the blood-brain barrier (i.e., GLUT-1), there should be only one $K_{T\text{-}MG}$ everywhere in the brain, and we have no reason to believe that it would change in pathology unless the blood-brain barrier is broken.

The news about our current budget and especially our travel funds is not good. We are being cut severely, and I don't know what this might mean to our travel to the Brain '93 meeting in Sendai. It is possible that none of us will be able to get the travel support from NIH to go. We will keep you informed.

Sincerely yours,

Louis Sokoloff

EQUATIONS:

1) $$m_{MG} = \frac{K_{MG}}{K_{IAP}} \times \frac{\lambda_{MG}}{\lambda_{IAP}} \times m_{IAP}$$

(Assume that $m_{IAP} = 1.0$ and that $\lambda_{IAP} = 0.8$)

Therefore,

$$\boxed{m_{MG} = \frac{\lambda_{MG}\ K_{MG}}{0.8\ K_{IAP}}} \quad \ldots\ldots\ldots [1]$$

2) $$m_{MG} = 1 - e^{-PS_{MG}/F}$$

(Note: $PS_{MG} = K_{1\text{-}MG}$)

Therefore,

$$\boxed{PS_{MG} = -\ 2.303 \times F \times Log_{10}\ (1 - m_{MG})} \quad \ldots\ldots [2]$$

(Note: $Log_e[X] = 2.303 \times Log_{10}[X]$

3) $$\boxed{PS_{MG} \times C_{P\text{-}MG} = V_{T\text{-}MG} - PS_{MG} \times K_{T\text{-}MG} \times (1+C_{P\text{-}glc}/K_{T\text{-}glc})} \ldots\ldots [3]$$

WARNING! All units must be in molecular concentrations of methylglucose and glucose and not in units of concentration of radiuoactivity.